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Effect of heavy loading on quality of SEBAGO POTATOES shipped by rail from Florida

**U.S. DEPARTMENT OF AGRICULTURE
Market Quality Research Division
Agricultural Marketing Service**

EFFECT OF HEAVY LOADING ON QUALITY OF SEBAGO POTATOES SHIPPED BY RAIL FROM FLORIDA

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SUMMARY

Sebago potatoes in heavy carloads (50,000 pounds), shipped from Florida to Michigan and Pennsylvania in recent tests, reached their destination with only a little more bruising than potatoes shipped in 36,000-pound loads.

Transit temperatures were only slightly higher in the 50,000-pound loads than in the 36,000-pound loads.

No excessive decay developed in these tests. Although in one test there was less decay in the 36,000-pound load than in heavier loads, the differences were probably not significant.

Potatoes can be shipped in heavy loads under an incentive tariff rate per car which results in a much lower unit cost than the regular tariff. Under the regular tariff the cost per 100-pound bag is the same for loads of 300 bags or more. The slight increase in bruising when heavier loads are used is not enough to offset the large saving in freight costs made possible by the per car rate.

INTRODUCTION

In the past, rail rates for shipment of potatoes and other vegetables from Florida and the Southeast were determined solely on a per hundredweight basis. For potatoes, the minimum charge was for a load of 300 bags (100 lb. each) per car. As an incentive for increasing the shipment of vegetables by rail east of the Mississippi River, shippers now have the alternative of a rate per car, which was established on November 24, 1957. Shippers of potatoes who use the per car rate can obtain more favorable rates per hundredweight by loading more than 300 bags in the car.

At the request of growers, shippers, and railroad representatives, rail transit tests were conducted from Hastings, Fla., to Detroit, Mich., and Berwick, Pa., to determine the effect of heavy loads on bruising, decay, and general market quality of potatoes.

MATERIALS AND METHODS

Two tests of three cars each containing various load weights of 100-pound burlap bags of Sebago potatoes were used to compare the amounts of bruising and decay which

¹ T. T. Hatton, Jr., L. J. Kushman, and M. B. Sunday, of the Market Quality Research Division, assisted in preparing these tests at the point of origin. Louis Beraha, P. H. Heinze, H. W. Hruschka, M. A. Smith, and W. R. Wright, also of Market Quality Research Division, inspected test packages at destination. Officials of Miles Potato Corporation and Florida Planters, Inc., provided potatoes, and officials of the Fruit Growers Express Company provided test rail cars. Special acknowledgment is given to Bruce Gray, member of the Potato Research and Marketing Advisory Committee, for his participation in the project.

² Rules and regulations governing the handling of perishable freight, Rule 385, Part 2, Perishable Protective Tariff 17.

developed during transit. On April 24, 1959, test cars A, B, and C, comprising the first test, were shipped from Hastings to Detroit with 360, 400, and 500 bags of potatoes, respectively. On April 29, 1959, test cars D, E, and F, comprising the second test, were shipped from Hastings to Berwick with 365, 406, and 505 bags per car. Special ventilation² with vents opened above 50° F. and closed below 50° F. was used on all test cars.

All test cars were standard end-bunker cars with heavy insulation and were equipped with sidewall flues and electric bunker fans. The fans were sealed in the "off" position in test cars A, B, and C, and in the "on" position in test cars D, E, and F, and remained in these positions during transit.

Test packages. --Fifteen 100-pound random samples of Sebago potatoes from the same field were obtained for each test (five for each car) from the grading belt and were sorted to eliminate all bruised and injured potatoes. The use of bruise-free potatoes insured that injury noted at destination occurred in transit. These samples of potatoes in burlap bags were placed in each car as follows: two at bottom quarterlength, one at top quarterlength, and one each at the bottom and top doorway. Upon arrival, these bags were carefully removed and inspected for bruising, decay, and other defects. A potato with 2 to 5 percent waste was considered to have "slight" bruising; damage involving 5 to 10 percent waste was "moderate" bruising; and damage involving 10 percent or more waste was considered "severe" bruising.

Commodity and air temperatures. --Small recording thermographs were placed in non-test packages in the center of four 100-pound bags in each car. These bags of potatoes were placed in the following positions at one end of the car: one at the bottom quarterlength, two at the middle quarterlength, and one at the top quarterlength. Thermographs were also used to measure outside air temperature and the air temperature inside the car above the loads.

RESULTS AND DISCUSSION

Test 1 (cars A, B, and C). --The amounts of bruising and decay which developed during transit from Hastings, Fla., to Detroit, Mich., are shown in table 1. No appreciable differences were noted in the amount of bruising between the 360-, 400-, and 500-bag carlots. Most of the bruising was slight. An average of less than 2.5 percent moderate and severe bruising was found in the bottom layer of potatoes. As expected, practically no moderate or severe bruising occurred in top layers during transit.

In this test less decay developed in the 360-bag carlot than in the 400- and 500-bag loads. There was considerable variation among the individual sacks in each car, so the differences in average percentage of decay are probably not significant.

Temperatures of the test carlots of potatoes during transit as recorded by the thermographs are given in table 2. The daily changes in outside air temperature apparently did not affect the temperatures within the packages even though the air temperatures within the cars were affected. Transit temperatures were slightly lower in the 360-bag load than in the 400- and 500-bag loads, but the differences were of little significance. There was a gradual reduction of about 5 to 15 degrees in potato temperatures during the transit period.

Test 2 (cars D, E, and F). --The amounts of bruising and decay which developed during transit from Hastings, Fla., to Berwick, Pa., are given in table 3. Relatively small amounts of decay and bruising of commercial significance (moderate or severe) developed in the 365-, 405-, or 505-bag carlots during transit.

The temperatures of cars D, E, and F during transit as recorded by thermographs are given in table 4. The daily variation in outside air temperature apparently had little

or no effect on the temperature within the packages. The potatoes in the various car-loads cooled during transit from 73° to 81° F. at loading to 55° to 60° at unloading. The 365-bag load cooled somewhat faster than the heavier loads.

Comparative costs. --Comparative costs per bag for shipping potatoes under the regular tariff and the incentive tariff are shown in table 5. Under the regular tariff, the cost per bag remains the same for loads of 300 bags or more. With the incentive rate per car, the cost per bag is reduced about 10 percent for a 300-bag load; if the size is increased to 500 bags, the cost is little more than one-half that of the regular tariff. Although no 600-bag load was used in these tests, several rail cars have been shipped containing this size of load. Shippers report little or no increase in bruising or decay. The cost per bag for this load is less than half that of the regular tariff.

Table 1.--Bruising and decay in Sebago potatoes as influenced by size of load and position of commodity in load, shipped from Hastings, Fla., to Detroit, Mich., April 24, 1959

Car, size of load, and position in load	Bruising			Total decay
	Slight	Moderate	Severe	
	<i>Percent¹</i>	<i>Percent¹</i>	<i>Percent¹</i>	<i>Percent¹</i>
Car A, 360 100-pound bags:				
Bottom quarterlength.....	4.9	1.4	0.9	0.3
Bottom quarterlength.....	8.1	1.5	1.3	3.4
Bottom doorway.....	7.8	2.7	.2	0
Average.....	6.9	1.9	.8	.9
Top quarterlength.....	4.9	.7	0	.7
Top doorway.....	.5	0	.2	1.5
Average.....	2.7	.3	.1	1.1
Car B, 400 100-pound bags:				
Bottom quarterlength.....	5.3	1.3	0	4.9
Bottom quarterlength.....	5.7	2.9	.3	.5
Bottom doorway.....	12.7	1.5	1.2	4.2
Average.....	7.9	1.9	.5	3.2
Top quarterlength.....	3.8	0	0	1.9
Top doorway.....	--	--	--	--
Average.....	3.8	0	0	1.9
Car C, 500 100-pound bags:				
Bottom quarterlength.....	5.4	0	.9	.6
Bottom quarterlength.....	8.3	3.2	0	1.5
Bottom doorway.....	11.8	1.0	.9	3.2
Average.....	8.5	1.4	.6	1.8
Top quarterlength.....	4.4	.9	0	3.5
Top doorway.....	2.3	0	0	2.9
Average.....	3.3	.4	0	3.2

¹ Pounds per 100-pound bag.

Table 2.--Transit temperatures of Sebago potatoes in 3 positions in carloads shipped from Hastings, Fla., to Detroit, Mich., April 24 to 28, 1959

Car, size of load, and position in load	At load- ing	Loading day		Days in transit												At un- load- ing
				1			2			3				4		
		12 m.	6 p.m.	12 p.m.	6 a.m.	12 m.	6 p.m.	12 p.m.	6 a.m.	12 m.	6 p.m.	12 p.m.	6 a.m.			
Car A, 360 100-pound bags: Bottom quarterlength..... Middle quarterlength ¹ Top quarterlength.....	°F. 65 65 65	°F. -- -- --	°F. 63 66 63	°F. 62 64 62	°F. 63 60 61	°F. 62 61 62	°F. 63 60 61	°F. 63 60 61	°F. 62 60 62	°F. 61 60 61	°F. 61 60 62	°F. 61 58 58	°F. 61 58 59			
Car B, 400 100-pound bags: Bottom quarterlength..... Middle quarterlength ¹ Top quarterlength.....	69 69 69	(²) -- --	-- 71 72	-- 68 69	-- 68 68	-- 68 65	-- 66 62	-- 66 60	-- 64 60	-- 62 59	-- 62 56	-- 60 54	-- 58 58			
Car C, 500 100-pound bags: Bottom quarterlength..... Middle quarterlength ¹ Top quarterlength.....	66 66 66	70 69 71	69 68 69	66 68 67	65 67 65	65 66 64	65 64 63	65 64 61	64 60 61	63 60 61	62 60 59	60 60 57	-- -- --			
Outside air temperature ¹	--	72	71	62	54	78	88	60	54	86	64	43	--			

¹ Average of readings of 2 recording thermometers.

² Thermometer failed.

Table 3.--Bruising and decay in Sebago potatoes as influenced by size of load and position of commodity in load, shipped from Hastings, Fla., to Berwick, Pa., April 24, 1959

Car, size of load, and position in load	Bruising			Total decay
	Slight	Moderate	Severe	
Car D, 365 100-pound bags:	<i>Percent</i> ¹	<i>Percent</i> ¹	<i>Percent</i> ¹	<i>Percent</i> ¹
Bottom quarterlength.....	0.4	0	0	0
Bottom quarterlength.....	0	0	0	0
Bottom doorway.....	.8	.8	0	0
Average.....	.4	.3	0	0
Top quarterlength.....	1.1	0	0	0
Top doorway.....	.7	.3	0	0
Average.....	.9	.1	0	0
Car E, 405 100-pound bags:				
Bottom quarterlength.....	.7	.8	.2	0
Bottom quarterlength.....	.7	0	0	.5
Bottom doorway.....	0	.3	.3	0
Average.....	.5	.4	.2	.2
Top quarterlength.....	.1	0	0	0
Top doorway.....	.3	.2	0	0
Average.....	.2	.1	0	0
Car F, 505 100-pound bags:				
Bottom quarterlength.....	.9	.6	.5	0
Bottom quarterlength.....	.7	.4	.1	0
Bottom doorway.....	.6	1.0	1.5	0
Average.....	.7	.7	.7	0
Top quarterlength.....	.9	0	0	.5
Top doorway.....	.4	0	0	0
Average.....	.7	0	0	.3

¹ Pounds per 100-pound bag.

Table 4.--Transit temperatures of Sebago potatoes at 3 positions in carloads shipped from Hastings, Fla., to Berwick, Pa., April 29 to May 3, 1959

Car, size of load, and position in load	Commodity temperature at loading	Loading day		Days in transit												Commodity temperature at unloading	Air temperature at unloading			
				1				2				3						4		
		12 m.	6 p.m.	12 p.m.	6 a.m.	6 m.	12 p.m.	6 a.m.	6 m.	12 p.m.	6 a.m.	6 m.	12 p.m.	6 a.m.	6 p.m.				6 a.m.	
Car D, 365 100-pound bags: Bottom quarterlength..... Middle quarterlength ¹ Top quarterlength.....	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	
	--	--	--	81	82	81	76	77	75	68	73	69	65	64	63	63	61	61	57	63 (8:30 am)
	--	--	--	79	83	79	74	78	67	69	66	67	65	61	61	59	58	58	58	63
Car E, 405 100-pound bags: Bottom quarterlength..... Middle quarterlength ¹ Top quarterlength.....	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.
	--	--	--	78	79	78	78	77	74	72	71	67	65	65	63	63	62	62	63	60 (8:30 am)
	--	--	--	75	77	76	75	74	71	69	68	67	66	65	64	63	63	62	62	60
Car F, 505 100-pound bags: Bottom quarterlength..... Middle quarterlength ¹ Top quarterlength.....	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.
	72	72	72	73	74	74	74	74	74	72	68	65	63	63	60	60	59	59	60	63 (10 am)
	76	76	76	76	76	76	76	76	74	71	68	66	66	65	62	61	60	60	60	63
Outside air temperature ¹ ..	--	81	80	73	82	92	64	56	50	61	96	58	66	61	60	59	60	60	--	--

¹ Average of readings of 2 recording thermometers.

Table 5.--Shipping cost per 100-pound bag of potatoes under regular tariff and under incentive tariff for 3 sizes of load, from Hastings, Fla., to 2 cities

Destination and incentive tariff rate per carload	Regular tariff (300 bags or more)	Incentive tariff		
		300 bags	500 bags	600 bags
Berwick, Pa., \$370.....	<i>Dollars</i> \$1.37	<i>Dollars</i> \$1.23	<i>Dollars</i> \$0.74	<i>Dollars</i> \$0.62
Detroit, Mich., \$381.....	1.43	1.27	0.76	0.63



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